

***SIMULIUM (PSILOPELMIA) TRAVISI* (DIPTERA: SIMULIIDAE),
A NEW BLACK FLY SPECIES FROM COSTA RICA**

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Abstract.—The male and female (pharate), pupa and larva of *Simulium (Psilopelmia) travisi*, new species, are described and illustrated. The new species is separated from its closest relative, *S. (Ps.) pseudocallidum* Díaz Nájera, by the form of the pupal respiratory organ.

Key Words: Diptera, Simuliidae, black fly, Costa Rica

The subgenus *Psilopelmia* is well represented in the Neotropical Region, especially in the Central American and Mexican subregions. It consists of 31 species: eight Nearctic (two in common with Central America), 23 from Central America, and 5 from South America (three in common with Central America), (Díaz-Nájera 1979, Coscarón 1987, 1990, Peterson 1992 personal comm.).

***Simulium travisi*, NEW SPECIES**

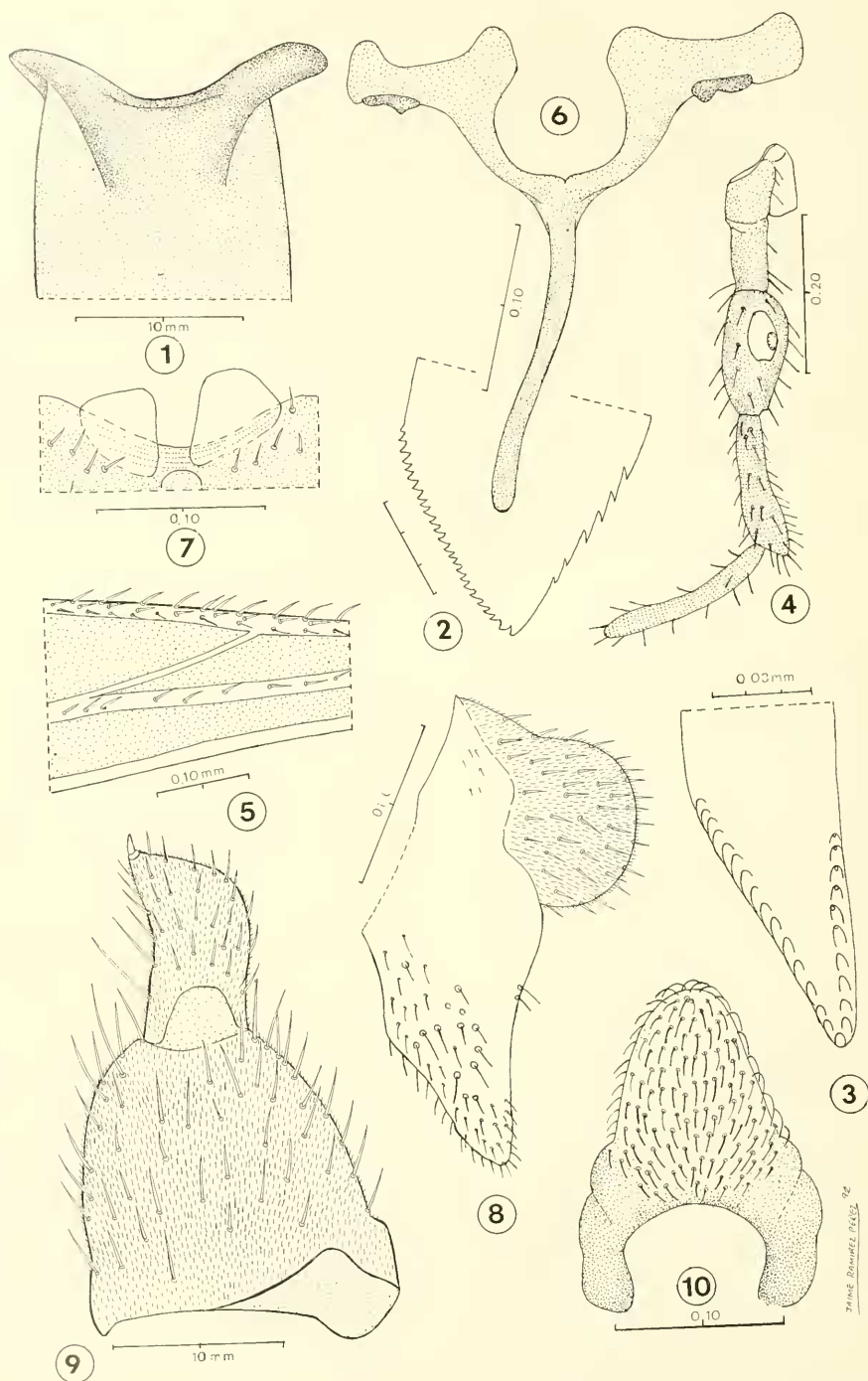
Description.—Female (pharate; preserved in alcohol).— General body color: apparently yellowish but faded because of the alcohol. *Length:* body, ? mm; wing, 2.9 mm, 1.15 mm at maximum width.

Frons with an interocular distance of 0.13 mm. Mandible (Fig. 2) with 25 teeth on inside margin and 6 larger teeth on outside margin. Blade of maxilla (Fig. 3) slender, with 25 retrorse teeth. Palpus (Fig. 4) with basal segment quadrate, 0.07 mm; second palpomere rectangular, 0.07 mm; third dilated, 0.15 mm; fourth, slender, 0.18 mm with apical portion directed to one side; fifth elongated, 0.22 mm long. Sensory vesicle moderately large, ovoid, with a small, round mouth. Palpal index about 1:1.1:2.2:2.6:3.3.

Cibarium (Fig. 1) with medioproximal space shallow, broadly concave, with a sclerotized margin, smooth at medial region; dorsolateral arm short, ending in an expanded, rugose lobe; inner surface of each arm with a patch of minute denticles arising from a slight prominence.

Sc and R_{2+3} without setae ventrally, R_1 bare on basal half, apical half with a mixture of setae and spines (Fig. 5). Antenna 0.54 mm in length.

Terminalia as in Figs. 6–8. Anal lobe (Fig. 8) subtriangular, external margin slightly concave, inner margin with a convexity at middle; anterodistal margin sinuous, covered with scattered setae of median size and fine pilosity. Cercus (Fig. 8) subrectangular, with round posterior margin, moderately covered with fine pilosity and stronger setae. Hypogynial valves (Fig. 7) very short, lobe shaped, barely reaching bases of cerci. Stem of genital fork (sternite 9) (Fig. 6) long and sclerotized, sinuous, longer than arms; each arm weakly sclerotized and ending in an expanded area, inner margin of arm with a slight concave area towards median line and a small convex area at each side. Spermatheca large, sclerotized, roundish, with-



Figs. 1-10. *Simulium travisi*. Figs. 1-8, female. 1, Median proximal space of cibarium. 2, Tip of mandible showing serrations. 3, Blade of maxilla showing retrorse teeth. 4, Maxillary palpus. 5, Portion of wing showing venation. 6, Genital fork. 7, Hypogynial valves. 8, Anal lobe and cercus. Figs. 9-10, male. 9, Gonocoxite and gonostylus (dorsal [inner] surface). 10, Ventral plate of aedeagus, ventral view.

out a reticulate pattern, with a few internal spicules, and a clear area at junction with spermathecal duct.

Male (pharate).—Terminalia as in Figs. 9, 10. Gonocoxite (Fig. 9) subquadrangular, with scattered long setae along distal and lateral areas. Gonostylus (Fig. 9) short, tubular, two times as long as wide, outer apical margin rounded, inner distal angle produced, with 1 moderately developed pointed apical spine; with scattered setae. Body of ventral plate of aedeagus (Fig. 10) pyramidal, densely covered with reclinate setae; in ventral view, with straight apical margin; basal arms well developed, sclerotized, spatula-like. Plate of endoparameral organ membranous, with marked striations, arms with 4 long, sclerotized spines.

Pupa.—Length, 3 mm. Respiratory organ (gill) (Fig. 16) consisting of 8 dark, slightly corrugated and granulose tubular filaments; dorsal filament more robust than others, ornamented; 7 mm long, 5 times as long as others that average about 1.5 mm. Branching pattern as follows: with 3 primary trunks, dorsal trunk wide at base, and with a ventral subbasal branch; and 2 other more ventral branches bifurcated at same level, medial trunk with same arrangement as dorsal trunk, and a ventral trunk with 2 filaments bifurcated at same level as dorsal bifurcation. The distal portion of each filament with fine annuli.

Head and thoracic integument covered by numerous microprotuberances and with some bare areas on frons distributed as follows: one slightly inclined pair of bands in upper part of cephalic region, a subtriangular medial area, ovoid spots on each side in basal region, and 4 ovoid medial areas.

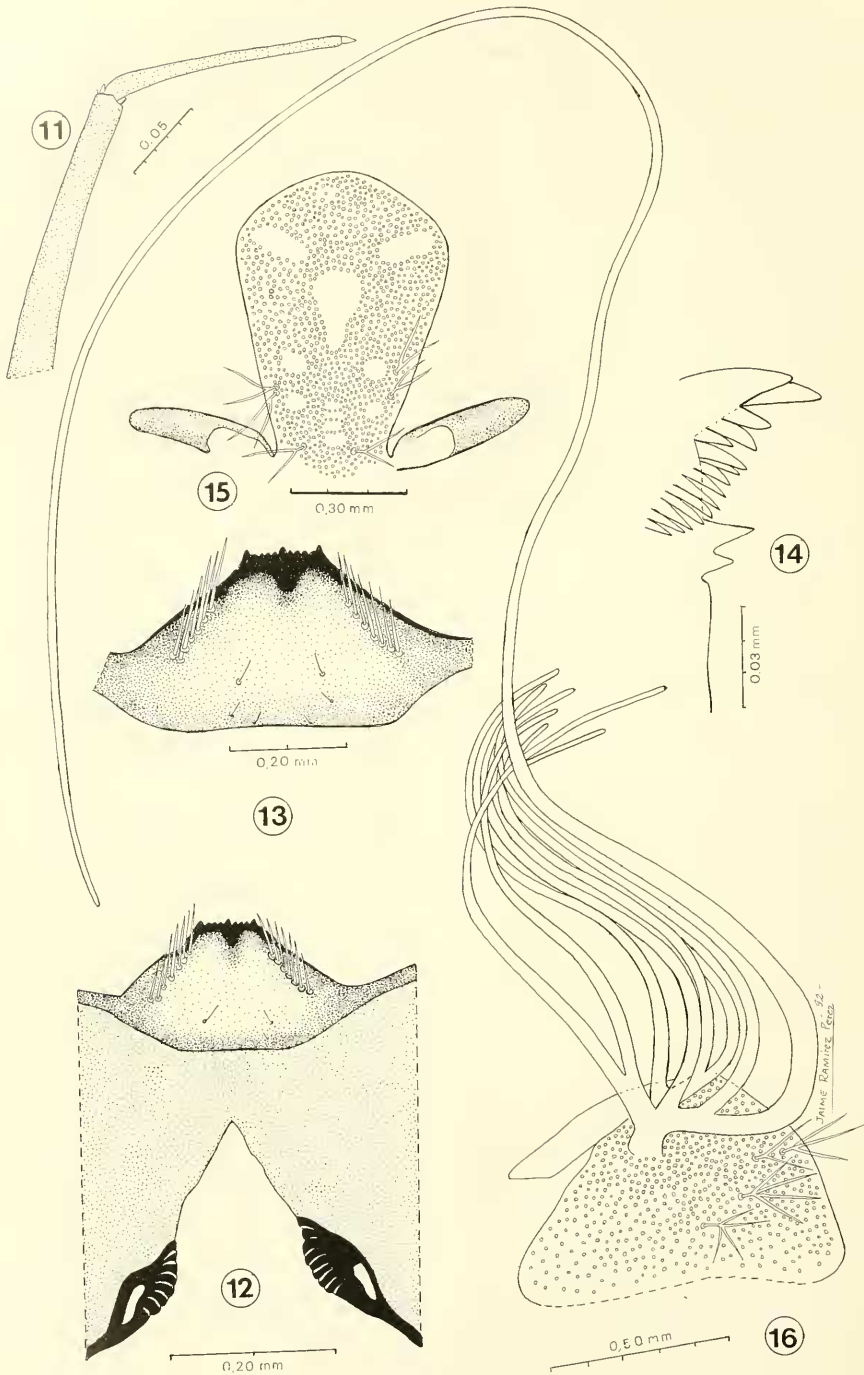
Frons of male pupa (Fig. 15) elongate, 1.5 times longer than wide, and with a convex posterior border. Frons of female not so elevated, mushroom shaped. Antennal envelopes of female reach posterior margin of head, male antennal envelopes reach only about half distance to posterior margin of head. Labral envelope of female pupa short-

er, wider and more roundish than that of male. Two pairs of long, bifid, submedial frontal trichomes and one pair of bifid basal trichomes. Female pupa with a single short, spine-like trichome towards midline at level of base of respiratory organ, and at side of respiratory organ there are 4 long tetrafid trichomes; 1 bifid trichome in line with respiratory organ and 1 long, simple, medial trichome ventral to base of respiratory organ.

Chaetotaxy of each lateral half of abdominal tergites as follows (from midline to lateral margin of abdomen): segment 0 = 1 long bifid seta. Segment I = 1 long simple seta. Segment II = 2 spiniform setae near midline, and anterior to them 5 small, single setae in a straight line, and 1 long, simple seta in front of external spiniform seta. Segment III = 4 single sclerotized hooks; 1 small seta in front of external pair of hooks. Segment IV = 4 single sclerotized hooks, 2 small simple setae, 1 in front and 1 beyond external pair of hooks, 4 simple setae and 1 bifid, lateral to external hook. Segment V = 1 simple lateral seta. Segment VI = 1 simple lateral seta. Segment VII = ?. Segment VIII = with a comb of 9 scales. Segment IX = with a rudimentary comb.

Chaetotaxy of each lateral half of sternites: segment III = 3 simple lateral setae, forming a triangle. Segment IV = bare. Segment V = 2 hooks, outer bifid, inner trifid, and 2 submedial and 2 submarginal simple setae. Segment VI = 2 bifid submedian hooks. Segment VII = 2 bifid submedian hooks. Segment VIII = bare. Segment IX = bare. Apex with 2 tiny terminal hooks on a wide lobe.

Larva (mature, with fully developed respiratory histoblasts).—Length, 6 mm. Antenna (Fig. 11), with first and second segments dark brown, third, pale brown, proportions of segments (basal to apical) 1:1.5:2.0. Labral fan with 40–43 primary rays. Hypostoma as in Fig. 13, with 9 teeth arranged as follows: 1 prominent central tooth, 2 lateral groups of 3 teeth each, and



Figs. 11-16. *Simulium travisi*. Figs. 11-14, larva. 11, Antenna. 12, Hypostomal cleft. 13, Hypostoma. 14, Inner distal and subapical margins of mandible showing dentation. Figs. 15-16, pupa. 15, Frons. 16, Respiratory organ (gill).

1 outer tooth followed by a prominence. Lateral margin of the hypostoma with 7–9 minute weak serrations; a row of 7 lateral hypostomal setae, 1 pair of submedian setae and 2 pair of subbasal setae; there is 1 pair of basal setae in line with laterals. Hypostomal cleft (Fig. 12) an inverted V-shape, deep, reaching 0.11 mm from base of hypostoma.

Mandible (Fig. 14) with 1 large, sclerotized apical tooth, 2 stout subapical teeth that are less developed than the apical, 3 moderately sclerotized outer teeth, followed by a series of 10 toothlike setae, 2 outer teeth with a minute tooth in between; mediobasal region of mandible with a patch of about 20 small spines; basoventral margin with 7 very large setae divided at apex into 3 points. Maxillary palpus stout, dark brown, with scattered setae, about 3.3 times as long as wide at base, distal end membranous, ending in a group of triangular spinules. Lateral plate of proleg extended about $\frac{1}{2}$ length of apical segment, subtriangular, slightly sclerotized, wider than its height; proleg with about 24 rows of apical hooks, each row with about 12 hooks; distal end of proleg with about 24 double pointed spines placed near base of rows of hooks. Anal papillae in 3 groups of about 11 lobes each. Antero-dorsal arm of anal sclerite strongly sclerotized, hornshaped, reaching posterior end of rings of hooks; posteroventral arm plate-like, slightly sclerotized and rugose; a band of non sclerotized scales encloses posterior arm, posterior circlet of hooks, consisting of about 15 hooks in about 100 rows.

Type data.—Holotype and paratypes deposited in the entomological collections, Department of Parasitology, School of Microbiology, University of Costa Rica. Holotype, ♀ (mounted on four slides) Río El Angel. Permanent stream (#66) located 4.1 km beyond Cinchona, on route from Vara Blanca to Puerto Viejo, Provincia Heredia, Costa Rica, November 16, 1970, C.R. R. Echeverri.

Paratypes.—1 ♀, same data as type (mounted on 2 slides); 1 ♀ (mounted on 4

slides), 2 ♂ (one mounted on 3 slides, other on 2 slides), permanent stream (#68) located 8.0 km beyond Tapezco, on route from Naranjo to Ciudad Quesada, Lajas, Cantón San Carlos, Provincia Alajuela, Costa Rica, August 4, 1969, C.R. M. Vargas, G. Zúñiga, R. Echeverri; 2 pupal skins (males) with larval cephalic capsule (mounted on 2 slides each), permanent stream (#67), located 6.7 km beyond Vara Blanca, on route from Vara Blanca to Puerto Viejo, Cantón Central, Provincia Heredia, C.R. January 30, 1992. M. Vargas, J. V. Vargas, J. Ramírez, S. Alfaro. One larva (mounted on 3 slides), temporary stream (#65), located 1.0 km beyond Cariblanco, on route from Vara Blanca to Puerto Viejo.

This species is named after, and dedicated to, the late Dr. Bernard V. Travis, first leader of the black fly bionomics project in Costa Rica.

Biological notes: All available specimens of *S. travisi* came from the central plateau of the Province of Heredia, and San Carlos, Province of Alajuela. This area is about 250 km² and is located between 84°10'00" and 84°25'32" and 10°12'41" and 10°17'31". Four streams in this area were positive for *S. travisi*: Qda. Ujarrás (numbered 65), Río el Angel (Numbered 66), Qda. Paz Chiquita (numbered 67) and Qda. Las Lajas (numbered 68).

According to Vargas and Travis (1973), these streams range between 800–1325 m above sea level, have temperatures between 14–26°C, depths between 0.20–0.50 m, widths from 2–10 m, have stream velocities varying from fast and turbulent (two streams), fast and with intermittent turbulence (one stream), and fast and nonturbulent (one stream). Three streams are clean and unpolluted, but stream number 65 is contaminated with organic material. Three of the streams are open-shaded, and one is partially shaded. Both rocks and vegetation are used as substrates for larvae and pupae.

Remarks: Until now, only three species of the subgenus *Psilopelmia* have been re-

ported in Costa Rica: *S. callidum* (Dyar and Shannon), *S. haematopotum* Malloch (Travis et al. 1974), and *S. panamense* Fairchild (Zeledón and Vieto 1957).

Of the 23 species of *Psilopelmia* in the Mexican and Central American regions, there are two in which the pupal stage is unknown: *S. escomeli* Roubaud of which only the male is known, and *S. jacobsi* Dalmat which is known only in the larval stage.

Using the number of filaments of the respiratory organ as a means of dividing the species of *Psilopelmia* into groups, *S. panamense* Fairchild, 1940, has twenty, *S. mangleirai* Vargas, 1945, has four, while *S. dandrettai* Vargas, Martínez and Díaz Nájera, 1946, *S. zenipoalense* Vargas, Martínez and Díaz Nájera, 1946, and *S. mazzottii* Díaz Nájera, 1979 have six. In the other 16 species, the respiratory organ has eight filaments, and *S. travisi* belongs to this group. Of these latter 16 species, only *S. callidum* and *S. pseudocallidum* Díaz Nájera have the outer dorsal filament more enlarged than the others. The filaments of all species are arranged in an archlike manner. However, in *S. callidum* and *S. pseudocallidum* the outer dorsal filament is about 1.7 times longer than the other filaments, and in *S. travisi* the same filament is about five times longer than the others.

A striking difference in the branching pattern of *S. callidum* and *S. pseudocallidum* is the bifurcation of the outer dorsal filament at some distance from the level of bifurcation of the ventral filaments, while in *S. travisi* the bifurcation of both the dorsal and ventral filament groups is almost at the same level.

The ventral plate of the aedeagus of *S. callidum* is bare, in *S. pseudocallidum* it is pilose, and that of *S. travisi* is pilose and longer than the former species.

On the other hand, the cibarium of *S. callidum* has a patch of spines on low prominences at each side; that of *S. pseudocallidum* is smooth and without denticles, and in *S. travisi* there are slight prominences and

patches of very minute spines (visible at 400 $\times$).

Finally, *S. travisi* is closely related to *S. callidum* and *S. pseudocallidum* but all three species can be separated from each other. The characters given by Díaz-Nájera (1965) to separate *S. callidum* from *S. pseudocallidum*, will separate *S. travisi* and *S. callidum*. Besides the slope of the respiratory organ, the shape of the ventral plate of the aedeagus, the number of rays of the labral fan, the number of rows in the posterior circlet of hooks of the larva, and the number of hypostomal setae will distinguish *S. pseudocallidum* and *S. travisi*.

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